Claims

1. A method of controlling a queue buffer (20) in a data unit transmission device (50), said queue buffer being arranged to queue data units (30) in a queue (21) and being connected to a link (40), comprising

determining (S1) a value (QL; QLav) of a length parameter related to the length of said queue,

comparing (S2) said value (QL; QLav) with a length threshold value (Lth) and performing (S3) a congestion notification procedure with respect to one or more data units from said queue if said value (QL; QLav) is greater than said length threshold value (Lth), and

an automatic threshold adaptation procedure (S5) that comprises estimating a link capacity value (LC) based on the data rate (DR) of said link (40) and adapting said threshold value (Lth) on the basis of said estimated link capacity value (LC),

characterized in that

said automatic threshold adaptation procedure (S5) is operable in one of at least a first and a second adaptation mode, said first adaptation mode being associated with minimizing queuing delay and adapting said threshold value (Lth) on the basis of $n \cdot LC$, where LC represents the estimated link capacity value and $n \geq 1$, and said second adaptation mode being associated with maximizing utilization and adapting said threshold value (Lth) on the basis of $m \cdot LC$, where $m > 1$ and $m > n$.

2. The method of claim 1, said queue buffer being arranged for receiving data units from a sender that performs window-based flow control and divides its send window by

k, k>1, when receiving a congestion notification or when detecting data unit loss, wherein n=k-1 and $m=k^2-1$.

3. The method of claim 2, wherein k=2, n=1 and m=3.

4. The method of one of claims 1 to 3, wherein a setting of said first mode or said second mode is done manually by an operator.

5. The method of one of claims 1 to 3, comprising an automatic mode setting procedure for setting said first mode or said second mode automatically.

6. The method of one of claims 1 to 5, comprising a loss indication event detection procedure for detecting potential data unit losses outside of said data unit transmission device (50) in a flow queued in said queue buffer.

7. The method of claim 6, wherein said loss indication event detection procedure comprises monitoring sequence identifiers of data units in said queued flow.

8. The method of claim 6 or 7, wherein said loss indication event detection procedure comprises monitoring loss indication information in acknowledgement data units sent from a receiver of said queued flow to the sender of said queued flow.

9. The method of one of claims 6 to 8, where said loss indication event detection procedure comprises:

a counting procedure for counting a number of data unit loss indication events occurring outside of said data unit transmission device in said queued flow, and

a procedure for deriving a characteristic count value from said counted numbers.

10. The method of claim 9, wherein said procedure for deriving a characteristic count value determines the number of loss indication events occurring outside of said data unit transmission device in said queued flow in each of p respective predetermined intervals, p being a natural number, and selects a maximum among said numbers as said characteristic count value.

11. The method of claim 10, wherein said predetermined intervals are defined as the time between two consecutive decisions of performing a congestion notification for a data unit in said queued flow.

12. The method of claim 9, wherein said procedure for deriving a characteristic count value determines an average number of loss indication events occurring outside of said data unit transmission device in said queued flow as said characteristic count value.

13. The method of one of claims 6 to 12 as depending on claim 5, wherein said automatic mode setting procedure takes an outcome of said loss indication event detection procedure into account.

14. The method of one of claims 6 to 13, where said automatic threshold adaptation procedure takes an outcome of said loss indication event detection procedure into account for dynamically adapting said threshold value (Lth) in said first or said second adaptation mode.

15. The method of one of claims 6 to 14, wherein said congestion notification procedure comprises a decision step for deciding whether to perform a congestion

notification procedure with respect to one or more data units, which decision step depends on the outcome of said loss indication event detection procedure.

16. The method of claim 15, comprising monitoring whether an event that indicates a potential data unit loss in a queued flow occurs within a predetermined period of time (GT) after it is detected that said value of said length parameter (QL, QLav) related to the length of said queue is greater than said length threshold value (Lth), and said decision step comprises not performing a congestion notification if an event indicating a potential data unit loss occurs within said predetermined period of time (GT), and otherwise performing said congestion notification.

17. The method of one of claims 1 to 16, wherein said queue buffer is arranged to hold at least a first queue and a second queue, said automatic threshold adaptation procedure adapting a first threshold value (Lth_1) associated with said first queue in accordance with said first adaptation mode and adapting a second threshold value (Lth_2) associated with said second queue in accordance with said second adaptation mode.

18. The method of claim 17, comprising a discrimination and placing procedure for discriminating data units to be queued on the basis of their contents and placing data units into said first or said second queue in dependence on a discrimination result.

19. A queue buffer controller (10) for controlling a queue buffer (20) in a data unit transmission device (50), said queue buffer (20) being arranged to queue data units (30) in a queue (21) and being connected to a link (40), comprising

a queue length determinator (101) for determining a value of a length parameter (QL, QLav) related to the length of said queue (21),

a comparator (102) for comparing said value with a length threshold value (Lth),

a congestion notifier (103) for performing a congestion notification procedure if said value is greater than said length threshold value, and

a threshold adaptor (104) for automatically adapting said length threshold value (Lth) by estimating a link capacity value (LC) based on the data rate (DR) of said link (40) and adapting said length threshold value (Lth) on the basis of said estimated link capacity value (LC),

characterized in that

said threshold adaptor (104) is operable in one of at least a first and a second adaptation mode, said first adaptation mode being associated with minimizing queuing delay and adapting said threshold value (Lth) on the basis of $n \cdot LC$, where LC represents the estimated link capacity value and $n \geq 1$, and said second adaptation mode being associated with maximizing utilization and adapting said threshold value (Lth) on the basis of $m \cdot LC$, where $m > 1$ and $m > n$.

20. The queue buffer controller of claim 19, said queue buffer being arranged for receiving data units from a sender that performs window-based flow control and divides its send window by k, $k > 1$, when receiving a congestion notification or when detecting data unit loss, said threshold adaptor (104) being arranged such that $n = k-1$ and $m = k^2-1$.

21. The queue buffer controller of claim 20, wherein k=2, n=1 and m=3.

22. The queue buffer controller of one of claims 19 to 21, comprising a setting mechanism for the manual setting of said first mode or said second mode by an operator.

23. The queue buffer controller of one of claims 19 to 22, comprising an automatic mode setting mechanism for setting said first mode or said second mode automatically.

24. The queue buffer controller of one of claims 19 to 23, comprising a loss indication event detector (105) for detecting potential data unit losses outside of said data unit transmission device (50) in a flow queued in said queue buffer.

25. The queue buffer controller of claim 24, wherein said loss indication event detector (105) comprises a monitor for monitoring sequence identifiers of data units in said queued flow.

26. The queue buffer controller of claim 24 or 25, wherein said loss indication event detector (105) comprises a monitor for monitoring loss indication information in acknowledgement data units sent from a receiver of said queued flow to the sender of said queued flow.

27. The queue buffer controller of one of claims 24 to 26, comprising:

a counter for counting a number of data unit loss indication events occurring outside of said data unit transmission device in said queued flow, and

a count number processor for deriving a characteristic count value from said counted numbers.

28. The queue buffer controller of claim 27, wherein said count number processor is arranged for determining the number of loss indication events occurring outside of said data unit transmission device in said queued flow in each of p respective predetermined intervals, p being a natural number, and selecting a maximum among said numbers as said characteristic count value.

29. The queue buffer controller of claim 28, wherein said predetermined intervals are defined as the time between two consecutive decisions of performing a congestion notification for a data unit in said queued flow.

30. The queue buffer controller of claim 27, wherein said count number processor is arranged for determining an average number of loss indication events occurring outside of said data unit transmission device in said queued flow as said characteristic count value.

31. The queue buffer controller of one of claims 24 to 30 as depending on claim 23, wherein said automatic mode setting mechanism is arranged for taking an output of said loss indication event detector into account.

32. The queue buffer controller of one of claims 24 to 31, where said threshold adaptor (104) is arranged for taking an output of said loss indication event detection procedure into account for dynamically adapting said threshold value (Lth) in said first or said second adaptation mode.

33. The queue buffer controller of one of claims 24 to 32, wherein said congestion notifier (103) comprises a decision unit (1031) for deciding whether to perform a

congestion notification with respect to one or more data units, which decision unit (1031) is arranged for taking into account an output of said loss indication event detector (105).

34. The queue buffer controller of claim 33, wherein said loss indication event detector (105) is arranged for monitoring whether an event that indicates a potential data unit loss in a queued flow occurs within a predetermined period of time (GT) after it is detected that said value of said length parameter (QL, QLav) related to the length of said queue is greater than said length threshold value (Lth), and said decision unit (1031) is arranged to not perform a congestion notification if an event indicating a potential data unit loss occurs within said predetermined period of time (GT), and to otherwise perform said congestion notification.

35. The queue buffer controller of one of claims 19 to 34, wherein said queue buffer is arranged to hold at least a first queue and a second queue, said threshold adaptor is arrange for adapting a first threshold value (Lth_1) associated with said first queue in accordance with said first adaptation mode and adapting a second threshold value (Lth_2) associated with said second queue in accordance with said second adaptation mode.

36. The queue buffer controller of claim 35, comprising a discrimination and placing unit for discriminating data units to be queued on the basis of their contents and placing data units into said first or said second queue in dependence on a discrimination result.